

HANOVER.

The forests of Hanover under State management extend over an area of 1,435,329 Prussian *morgen*, equal to upwards of 900,000 English acres. (The Prussian *morgen* is $\cdot 63093$ of the English acre, the old Hanoverian *morgen* being $\cdot 6477$ of the English acre.) This extent is classed as—

Area and
classification.

- a. 937,673 *morgen* Government Forest (591,000 English acres).
- b. 53,806 *morgen* ecclesiastical or "Kloster" forests now secularised (34,000 English acres).
- c. 261,116 *morgen* Communal forests (165,000 English acres).
- d. 182,734 *morgen* Government moors and peat mosses (115,000 English acres).

The forests under class *a* are entirely the property of the State, although burdened in many cases with communal or individual rights and servitudes; those under *b* were formerly church property, now secularised by Act, and are managed by the Forest Department on behalf of the special department or board appointed for their administration. The profits are mainly devoted to educational and charitable purposes.

Class *c* are Communal Forests under Government management in accordance with the provisions of an Act which provides that they shall be managed entirely by the Government officers, but that the surplus annual yield of wood shall be entirely the property of the community, to devote to their own purposes or sell as they may think best. The community pay one groschen ($1\frac{1}{2}d.$) per *morgen* towards the pay of the officers in charge, unless the forest is of sufficient extent to justify the employment of a special officer, in which case they are debited with the total amount of his pay and allowances as well as with the disbursements for subordinate establishments and working charges.

Under class *d* are included extensive waste tracts, which in many cases are now being gradually planted with Scotch fir, and a considerable area of peat-bog or moss.

The annual yield of the forests during the four years from 1859 to 1863 inclusive was nearly 45 millions of cubic feet (of which about 10 millions of cubic feet were handed over to persons having rights and privileges) representing an

Yield.

average yield per morgen of the cultivable area of about 37, and of the area actually covered with forest of 40 cubic feet per annum.

In the tables from which this information is taken the average yield of the hill forests is shown as much higher than that of those in the plains, the former yielding from 52 to 64 cubic feet per morgen, whilst the latter did not average more than 30.

Receipts and
disbursements.

Director Burekhardt gives me the annual receipts from the Government Forests at two millions of thalers, or 300,000*l.*, whilst the annual disbursements during the years 1859 to 1863 amounted to thalers 455,138 for working charges, and th. 390,688 for establishments, pensions, land tax, &c., making a total of th. 846,426, say 128,000*l.*, and a nett surplus revenue of 162,000*l.*

These figures must not, however, be taken as perfectly accurate. The fullest information is given in Burekhardt's "*Forstliche Verhältnisse des Königreichs Hannover*" (published in 1864), section VIII. pp. 69 to 99; but, as there pointed out, it is difficult to separate some of the charges, as the Harz Forests were until recently worked separately, and payments on account of mines, post roads, &c., included in the forest budgets, whilst the contributions of communities towards the payment of fixed establishments introduce an element of complication, especially in the case of communal forests with no actual cash receipts, or where these fall below the total amount of disbursements. Again the annual value, of grazing, forest products, &c., is estimated at thalers 741,420, or 108,213*l.*, but only a tithe of this sum is actually collected and credited in the accounts, the rest being free to all or to the inhabitants of certain villages in the neighbourhood of the forests.

Establishments.

The charges include considerable sums paid in commutation of rights and servitudes, and for forest surveys and valuations (*Massenaufnahmen*), which will gradually diminish.

Hanover being now, and since the year 1866, a province of the kingdom of Prussia, the forest establishments are gradually being remodelled and organised on the Prussian system, the leading characteristics of which are strong control and supervision.

The head office of the department for the whole kingdom is, of course, in Berlin, where it forms part of the finance department, which is divided into three heads or sections: I. Direct taxes; II. Crown lands; III. Forests.

The Forest establishments of the province of Hanover consist of 1 *Forstdirektor* and *Ober-forstmeister*, who is also a

councillor, 20 *Forstmeister*s in charge of circles or divisions, forming also a committee or board of management and reference in all forest matters; 112 *Oberförster*s in charge of forest districts (*Revier*) averaging 11,000 morgen each, 403 *Forster*s who assist the *Oberförster*s, and have charge of portions of a *revier*; 343 overseers, under-foresters, &c., employed in watching and protecting the forests and supervising the work which is executed by hired, weekly, or daily labour, or on contract under supervision of the fixed establishments. A "*Forstrendant*" or cash keeper is attached to each *Oberforsterei*, who receives and disburses all moneys in and from the forest cash chest, with which the *Oberförster* has nothing to do, although his accounts of sales, &c., should of course tally with those of the *Forstrendant*. For payment of labourers, &c., he gives orders on the forest cash chest, which are paid by the *Forstrendant*, whose books and cash balances are examined periodically by the *Forstmeister* in charge of the division, and accounts rendered to the head office of account in Hanover, and thence to Berlin.

In order to understand more clearly the position and nature of the duties appertaining to each grade or class of officials, it is necessary to bear in mind that the forests have all been surveyed, valued, and divided into blocks, and that there are accurate maps or plans representing not only the extent and situation of each forest district, but, by the use of different colours and shades of colouring, the description and age of the timber growing in each block or sub-division.

It appears advisable to describe briefly how this is effected, and the valuations (*Massenaufnahmen*) and plans maintained and renewed so as to form always reliable data for information and guidance. Valuation surveys.

Besides the employés already enumerated, there exists an office and numerous staff for the sole purpose of measuring, valuing, and forming working plans for the forests. This is called the "*Einrichtungs Bureau*," and the work carried on by it is perfectly distinct from that of the ordinary forest management and administration. In fact all preliminary arrangements and settlements are worked out in this office, and when complete and sanctioned by the *Forst Direktor* are carried out by the executive under the supervision of the *Forstmeister*s. The office consists of a superintendent (*Vorstand*), draughtsmen, and clerks, generally practical foresters, and a staff of surveyors (*Geometer*) and forest valuers (*Taxator*), who are as a rule candidates for the position of *Oberförster*.

When a forest is (or more properly speaking *was*) about to be taken in hand and worked systematically, a surveyor

and valuator are despatched to the spot, the former working under the directions of the latter, who places himself in communication with the local forest officer and inhabitants interested, and obtains from them all the information in his power. The surveyor first surveys the whole district or tract, then the several blocks or subdivisions; as pointed out by the valuator, who defines them according to the description and age of the timber now standing, the situation, nature of soil, climate, and any other conditions affecting the rate of growth and nature of the crop which it may be advisable to grow in future years. Whilst the surveyor is engaged in demarcating and surveying these blocks the valuator is employed in making valuations of the standing crop, calculating the annual rate of growth, inquiring into and forming a register of rights and servitudes with a view to their commutation, considering the best plan for working the forest for the future, the roads which it will be necessary to construct for the transport of timber; in fact all the conditions of the forest which will enable him to prepare a detailed plan for future management (Einrichtungs plan), and the subordinate plans and instructions (Wirtschafts pläne, &c.) for a term of years, to be handed over to the executive officer as his "standing orders."

A complete code of rules for the guidance of the valutors has been drawn up and printed, in which every possible contingency or difficulty is taken into consideration and provided for.

Having obtained all the information which he can on the spot, and ascertained the views and wishes of the inhabitants of the surrounding villages having rights or privileges in the forest, the valuator and surveyor return to head-quarters, and proceed to prepare the working plan, maps, &c., from their notes and measurements.

When these are completed they are submitted by the superintendent of the bureau to the board or committee composed, as already stated, of the forstmeisters, and presided over by the Forst-Direktor and other councillors of the Finance Department, who examine the plan in all its details, and are prepared to listen to any objections which may be made on the part of communities or individuals. These are, however, I am informed, very rare nowadays, as the people have learnt that the action of the Government officers is not antagonistic to their interests, and are as a rule willing to allow them to settle matters to the best advantage.

The labours of the commission were formerly much greater than now when they consist almost entirely in ex-

amining and revising the working plan submitted for their approval with regard to its merits as a part of the system of scientific forest management and conservancy. If palpable errors in calculation of yield, rate of growth, nature of the soil, are detected, or the measurements found to be inaccurate (a very small margin for error is allowed), the valuator may be ordered to do the work all over again without remuneration, for it should be stated that the valuator, surveyor, and, indeed, most of the officials of the "*Einrichtungs-Bureau*," are paid only when actually employed on any particular work, being at the same time enrolled as candidates or probationers for the post of "*Oberförster*" or "*Förster*." As a rule the calculations and plans based on them are correct, having been thoroughly checked and overhauled in the office, and if all is approved they are made out in triplicate and signed by the Forst-Direktor and Forstmeister of the division, one copy being sent to the executive officer for his guidance, another retained by the Forstmeister, and the original at the head-quarter office for reference.

The "*Preface*" to the working plan contains a short history of the forest, its capabilities, requirements of the neighbourhood, &c. A sample of the headings into which it is divided is given at page 64, although no arbitrary rule or form appears to be laid down, and they vary according to circumstances and the views of the officers who prepare them.

The executive officer has thus in his hands accurate maps, on a large scale, showing each division and subdivision of the forest tract placed under his charge, and instructions for its management down to the minutest detail, the quantity to be felled annually, the extent planted, the state in which the forest should be found 10, 20, or even 100 years after the plans were drawn up; all these are calculated and laid down so that any change in the executive in no way interferes with the progress of operations, for all that the *Oberförster* has to do is to carry out the instructions given him, a margin being of course allowed for his discretion, and every allowance made for deviations from the working plan on account of natural and unforeseen causes, such as failure of seed, occurrence of storms by which thousands of trees are sometimes levelled to the ground, and the routine or systematic management interfered with for years, as the establishments are employed in working up and removing the fallen trees.

The *Forstmeisters* have no executive work, their duties being confined to the supervision and control of from four to six *Oberförstereien* or *Reviere* (vide Note, page 35); in

Duties of
Forstmeisters
and Ober-
försters.

fact they may be considered as occupying a position analogous to our deputy conservators, whilst the *Oberförsters* may be classed as assistants.

Our deputies and assistants in India have often been employed on exactly similar duties, but such is never the case here, where the control and even, as we have seen, the demarcation, valuation surveys, and preparation of working plans are kept perfectly distinct from the local executive, whose business it is to carry out the carefully digested plans and orders received from the controlling branch. Other systems have been tried but none have been found to work so well as this, which combines the advantages of efficient administration and supervision by officers who have themselves gone through the executive grade and who are individually and collectively qualified to organise and supervise the work of others, with the concentration of the energies of the local officer on his own charge with the object of carrying out to the best of his ability the orders he receives without troubling him or diverting his attention by making him responsible for the general plan of operations which forms part of that which is considered most applicable and beneficial for the whole nation or province.

The Forstmeisters make frequent inspections of the several districts in their division (*Bezirk*) and thoroughly supervise the work of the *Oberförsters* and their subordinates both in the forest and office work, reporting on the same to the *Direktor*. The *Oberförsters* submit annual reports comparing operations actually carried on with those prescribed in the working plans, and giving reasons for any material divergence from them. They spend the greater portion of their time in the forest supervising the felling, planting, sowing, thinning, carting, and selling of timber. The laying down of roads is generally entrusted to one or more forest officers with special qualifications or aptitude for that work, but the actual work is carried out by the local officer. He has also a considerable amount of office work, issuing of licences for grazing, &c., and preparation of reports, returns, and accounts; but his duties may be considered as mainly out of door in comparison with those of the Forstmeister, who has more office work, comparing the result of operations and the rates in the several districts, collecting information and statistics for future guidance, settling disputes and affording advice and assistance to his subordinates, and, as a member of the forest commission or committee, considering and revising working plans submitted from the "*Einrichtungs Bureau*."

The main object aimed at in any system of scientific forestry is, in the first instance, the conversion of any tract or tracts of natural forest, which generally contain trees of all ages and descriptions, young and old, good and bad, growing too thickly in one place and too thinly in another, into what is termed a "*geschlossener Bestand*" (closed or compact forest), consisting of trees of the better descriptions and of the same age or period, divided into blocks, and capable of being worked—i.e., thinned out, felled, and reproduced or replanted—in rotation, a block or part of a block being taken in hand each year. In settling and carrying out such a system important considerations and complications present themselves, such as the relation of the particular block, district, or division to the whole forest system of the province; the requirements of the people, not only as regards timber and firewood, but straw, litter, and leaves for manure, and pasturage; the geological and chemical formations and properties of the soil; and the situation as regards the prevailing winds, on which the felling must always depend, in order to decrease the chances of damage to a minimum; measures of precaution against fires, the ravages of destructive insects, trespass, damage, or theft by men and cattle; all these must be taken into consideration and borne in mind at each successive stage.

The aim of scientific forestry.

Nor must it be supposed that when once an indigenous forest has been mapped, valued, and working plans prepared, the necessity for attending to all such considerations is at an end. On the contrary, it is found necessary to have a revision of the working plan every 10 or 20 years, when new maps are prepared showing the progress made towards the objects laid down in the original scheme, and although it is marvellous how generally the plan of operations is found to have answered and been adhered to on the whole, still the necessity of modifications and alterations of system do more or less present themselves. It may be found advisable to change the crop as in agriculture, to convert a hard wood into a coniferous forest or vice versa, to replace oak by beech, or to plant up (*unterbau*) the former with spruce or beech to cover the ground and keep down the growth of grass. All these and a hundred other details are constantly presenting themselves for consideration and settlement, and the local officer should be ever on the alert to detect the necessity of any change and bring it to notice, no less than the controlling branch should be prepared to suggest what is best to be done, and conversant with what had been done and with what results under similar circumstances in other districts and provinces.

Districts
visited.

Having thus given a general outline of the duties of the forest employes, and how the forest is first "taken up," divided, mapped, valued, and plans laid down for its future management, I shall state briefly what I saw of the practical working and how the actual forest operations are carried on. I visited 12 districts or reviers with Director Burckhardt or one of the forest officers, and went thoroughly into the details of management, the various methods of planting and sowing (artificial and natural), treatment of young trees in the nursery, thinning, removal of undergrowth, "*unterbau*" or planting up, felling, conversion of timber trees into logs or billets, removal from the forest, piling or stacking, and sales by auction; and whilst thus engaged in seeing operations in progress endeavoured to master the details of the system and general plan of operations by the study of books on forestry, in which Germany is very rich, rules and regulations for the guidance of the forest officers and subordinates, working plans, &c., &c.

As I spent most of my time in the reviers of Springe and Lauterberg-am-Harz, I shall confine my remarks mainly to these districts.

Springe Revier.

The Springe Revier is situated in the neighbourhood of the town of Hanover, from which it is reached by diligence in three hours (a railway has just been opened). The forest, which includes an extensive game preserve known as the "*Sau-Park*," may be considered as in the plains although it ascends and clothes the sides of a low range of hills. The *Oberförsterei* is extensive, covering an area of some 19,000 morgen, or about 12,000 acres, mainly covered with oak and beech forest. Favoured by situation and depth of soil, the formation is mostly oolitic limestone and sandstone, the growth in this revier would be exceptionally good were it not for the damage done by the deer and wild pigs, which is very great, so much so that it has been found necessary to fence off the portions being cleared to allow of natural reproduction taking place.

Natural
reproduction.

As this plan of natural reproduction forms one of the most important points in the German system of forestry, it appears as well to describe here how it is conducted.

It has been already stated that the *Umtrieb*, or rotation of crop and periods into which it is divided, are fixed in the working plan. The usual *Umtrieb* for beech hoch-wald in Hanover is 120 years, divided into six periods of 20 years each, that is to say, when the forest has been brought into proper order there should be as nearly as possible equal areas under crop in each of the six periods, viz., from one year to 20, from 20 to 40, and so on. It is not imperatively neces-

sary that the total extent in each period should be together; there may be 500 acres in one place and 50 in another, but it is advisable to group them as much as possible and work each tract regularly in succession, having regard to the direction of the prevailing winds, which do incalculable damage if once allowed to get into a forest by injudicious felling on the windward side. When a block arrives in the last period felling is commenced by what is called a *Vorber- eitung* or *Besamungs-schlag* (preparatory or seed-clearing), which is very slight and scarcely to be distinguished from the ordinary thinning carried on in the former periods. This is followed by a *Licht-schlag* (clearing for light) in the first year after seed has fallen (the beech seeds every fourth or fifth year) with the object of, 1st, preparing the ground to receive the seed; 2nd, allowing it to germinate; and, 3rd, affording sufficient light to the young seedlings. The finest trees are, as a rule, left standing with the two-fold object of depositing the seed and sheltering the young trees as they come up. If there is a good seed year and sufficient rain the ground should be thickly covered with seedlings within two or three years after the first clearing, but it is generally found advisable to wait for a second seed year and aid nature by hand sowing, transplanting from patches where the seedlings have come up very thickly to the barer spots, and turning up the turf, and so giving the seeds a better chance of germinating (*vide* Report on Lord Seafield's woods), page 96.

When the ground is pretty well covered the old trees are felled and carefully removed, so as to do as little damage as possible to the new crop, and the block recommences life, so to speak, nothing further being done until the first thinning.

The time allowed to elapse between the preparatory and the final clearing naturally varies much, according to situation and circumstances. In Hanover it rarely exceeds 15, and is often as little as 8 years, but there would appear to be a growing tendency in other provinces to do away with this system of so called "*Kahltrieb*," and remove the old trees so gradually that there can scarcely be said to be any clearing at all, the new crop being well advanced before the last of the parent trees is removed. This new system finds much favour in the Black Forest, as will be explained hereafter. At Springe the woods in the first period, where the final felling was going on when I was there, had, as I have stated, been fenced off so as to exclude the deer and pigs, and the natural reproduction had been particularly good, the hill slopes being thickly covered with seedlings;

but a new and formidable enemy had presented itself in the shape of field mice, which nibble round the bark just above the surface of the ground. Thousands of seedlings had thus been destroyed, and as fast as blanks were filled up by transplanting the young trees were attacked and killed. I left the Oberforster in despair at the wholesale destruction which was thus going on, and which, with all the knowledge and appliances of modern forestry at his command, he was powerless to prevent; but I have no doubt a sufficient stock will, after all, be left, supplemented by a little transplanting from the nurseries, which are well stocked.

The deer do great damage in the older beech woods by stripping the bark from the trees. These have then to be felled within a year or eighteen months, which interferes with thinning operations in other localities, and precludes any regularity in carrying on operations and bringing the forest into proper order. These beech thinnings are cut into billets and piled ready for sale as firewood. The price realised is only about 4s. 2d. per cubic metre, say, 1½d. per cubic foot, which is very low.

I inspected tracts containing oak, beech, &c. representing all the periods, and compared the growth as recommended by Dr. Brandis. There are some very fine beech woods in the second and third periods, but to my eye they required thinning, having fully double the number of trees to the acre which would be left in England. This, however, I afterwards found universal in German forests as compared with those I have seen in England and Scotland, and forms a vexed question on which much has been said and written on either side, too much to be summarized in this report; probably a happy medium would be found to be the best, and the peculiar circumstances of climate must always have much to say in such matters.

Presence of
grass in
plantations.

It may, however, be stated with reference to the remarks regarding pasturage in my report on the Scotch forests, page 107, that the presence of grass in plantations or young woods is throughout Germany considered as a sure sign of a faulty system of treatment, and consequently more or less unhealthy state of the trees. It is mainly with the object of preventing this that oak woods are planted up with beech, which grows well under shade and covers the ground so as to exclude the light, which, if admitted, must produce a growth of grass or herbage. The conditions under which the oak grows best being tersely expressed in German "*Kopf frei boden bedeckt*" (Anglicè, Crown free soil covered or sheltered). I have, however, seen grass growing in English

plantations which were very thick, and into which little or no light could penetrate, and am inclined to think that our moist sea climate has as much to do with it as the greater distance from tree to tree and the absence of "*Unterbau*." There is no doubt that the droppings from some descriptions of trees, particularly the larch, are very favourable to the growth of grass both before and after the trees are felled, as they produce a rich and fertile humus; and, although I am inclined to agree with the Germans that but little or no grass or herbage should be found in plantations in Europe, its presence in our Indian plantations does little or no harm to the trees, as it tends to keep the soil moist and shelter it from the fierce rays of the sun, and that in any case the immense advantage of increasing the supply of green fodder by having the grass cut during the first few years and cattle admitted after the trees are past harm's way, more than counterbalances any negative damage to the trees or sacrifice in annual growth. In short, the presence of grass is no evil in itself, and the forester must never lose sight of the necessity of getting the ground in his plantations under cover in order to keep the soil loose, and enable the atmospheric air to penetrate to the roots. This appears all important. Of course, in mature or nearly mature forests, whether planted or indigenous, little or no grass should ever be found.

With regard to the *Unterbau* or planting up and rearing "*Unterbau*." of two crops at the same time, the general opinion of English forest officers is antagonistic, and I myself thought it impossible without more or less detriment to both, and great damage to the young growth in removing the old crop; but I am now convinced, from what I have seen, that it is not only practicable and easily carried out by the exercise of a little ordinary care, but is, as a rule, highly beneficial and deserving of being introduced, at least in a tentative manner, in England, and certainly in India, where we have, as in Germany, to provide a supply of firewood as well as building timber. I am convinced that if we can find the proper trees to grow under shade a great step will be made in our Indian forestry, and our plantations prove much more healthy and remunerative than hitherto. In this I am sure all our officers who have seen and studied the German system will agree, and where the undergrowth is for firewood and not to be reared as timber, the difficulty, small as it is, of removing the old crop is obviated by the *Unterbau* being removed first; in fact, it is probably cleared four or five times before the timber crop matures. As regards

England, there is the difficulty that there would be little or no demand for the beech as firewood, and it is of little value for any other purpose; but I am inclined to think that such a demand will arise if the price of coal continues to increase, and that even if the planting up of oak woods can be made to pay its expenses a great point will be gained in the improvement in quality and more rapid growth of the oak; for it must be borne in mind that the main object of beech or spruce under oaks or Scotch firs, &c. is to cover the ground, to the importance of which I have just alluded, and not to produce firewood.

Planting out of
hard wood.

During my stay at Springe I saw also a good deal of planting out of hard wood trees from the nurseries, and in this respect also there is a good deal of difference from what is usual in England. In Hanover the seedlings are transferred at the age of from two to four years from the seed beds into the "*Schule*" or nursery, where they are trained, pruned, and transplanted as often as required until finally planted out, which is sometimes not done till they are 12 or even 14 years old. So far the treatment does not vary much from that adopted in our nurseries in England, save that I think trees are rarely with us planted out so late, excepting for ornamental purposes, avenues, or other quite exceptional cases. Here we find the planting out of 10 to 12 and even 14-year old trees (called *Heisters*) the rule, and they are almost invariably put out without any nurses, although these may be and generally are added a few years later in the shape of coniferæ of four or five years old planted between the rows or beech *Unterbau*. I do not mean that young hard woods are never planted out at five or six years of age, but it is exceptional; and in no case that I have seen or heard of were nurses planted with the trees as with us, still less before the hard woods, as in the New Forest.

The oak and beech *Heisters* after, say, 10 years schooling are lifted, the branches carefully pruned into, as nearly as possible, a pyramidal form; the roots trimmed and shortened, the more woody parts being even sawn off, and only the fibrous rootlets left, and the trees then planted out in pits which are dug just large enough to receive them. The distance apart at which they are planted varies according to situation from eight to twelve feet.

Planting out of such large trees is naturally rather expensive, but I was told it ought not to average more than $1\frac{1}{2}d.$ each, all expenses included, which seems very low, considering that two men cannot plant more than 100 a day (including, of course, the digging of the pits), and that

the cart hire from the nursery to the plantation site is expensive.

The absence of nurses struck me as very remarkable and deserving of attention, and I have since found it universal throughout Germany; in fact, the German foresters could not understand how we can manage with nurses (especially spruce, Scotch fir, or larch, which grow so rapidly at first) of the same age as the hard woods. Absence of nurses.

They often plant spruce some years subsequently, and point out that even then it generally overtakes the hard woods, and has to be cut down, which they do immediately its head shows above that of the oak or beech, and again and again if necessary before they (the spruces) are finally removed. I am not competent to express an opinion as to which system is correct, but both cannot be, and I must say I cannot recall an instance of damage done to hard woods in Germany by the absence of nurses, whilst I have seen them injuriously crowded and their growth impeded by their presence in England.

I brought my stay at Springe to a close by an interesting visit to the Communal forest belonging to the town, and managed by a subordinate forest officer paid by the community, but who works entirely under the orders of the Government forest officers. One portion of the beech forest was particularly interesting, in which he was clearing and encouraging reproduction very gradually and carefully, as there was great danger, owing to the situation, of too much light being admitted, which acting on a very rich soil, would result in a very rank growth of grass and weeds sufficient to choke the seedlings. The result appeared very good, and does credit to the intelligence of the *Revierförster*. Communal forest.

The timber from this forest is taken by the burghers, each of whom is entitled to a certain annual quantity, and it is the duty of the forest officer in charge to supply this quantity and still retain the forest in good state—no easy task.

Beyond this, however, he has nothing to do with the burghers, who have no say in the management or working of the forest, nor can they alienate nor clear for cultivation any portion, although it is exclusively their property, and the State derives no benefit from it beyond the preservation of the timber and clothing the hill sides, which is considered, even in this temperate climate, a matter of paramount importance. The burghers cut up and cart away their allotments of timber at their own cost, and are free to dispose of or retain it for their own use as they may think best.

Some such system might, I think, be adopted with advantage in India for the management and preservation of our village forests.

Lauterberg
Revier.

The Lauterberg Revier is situated on the lower slopes of the Harz mountains, and is 15,000 morgen (about 9,400 English acres) in extent. The geological formation is of the Silurian period, consisting mainly of clayslate, and grauwacke, and the soil is formed from the decomposition of the underlying rock more or less mixed with vegetable mould. The low-lying portions of the revier are covered with beech forests, which, as one ascends, give place to spruce intermixed with Scotch fir, and here and there a little larch. There is but little oak in the revier, but a good deal of hornbeam (*Carpinus Betulus*) interspersed with the beech.

The revier is particularly interesting and instructive from the opportunities it presents of observing the growth and treatment of both hardwood and coniferæ in the plains and on the hill sides. In fact almost every variety of treatment, sowing, planting, felling, and preparation may be met with and studied advantageously in this and the adjoining reviers in the Hanoverian Harz. The Oberförster, Herr Ohnesorge, is most painstaking, and ever anxious to explain and make things clear, which he is particularly well qualified to do, from his extensive and varied knowledge of forestry and the sciences connected with it. I have to thank him heartily for the trouble he took; to which I am mainly indebted for the insight I obtained into the details of German forest management and the object of each particular treatment or plan of operations. Several of our forest probationers have already benefited by his teaching, and all speak in the highest terms of his never-varying kindness and desire to get them on with their studies.

I spent three weeks on the revier along with Mr. Amery, a forest officer from the Punjab. The forests are almost entirely Hochwald, and the annual growth or increase of wood is estimated at as high as 50 cubic feet per morgen (80 cubic feet per English acre), the umtrieb being 120 years (for beech). This annual increment represents a total yield during this period of 6,000 cubic feet per morgen, or upwards of 9,500 cubic feet per acre, which is a high average. It is estimated that from one-fourth to one-fifth of the total yield is removed by thinning, but this varies much according to description of tree and situation.

We visited with the Oberförster portions of the forest representing all the periods of growth; nurseries and schools

for seedlings; and witnessed planting being carried on in many different ways to suit the necessities of soil and situation; felling by the axe and with the crosscut saw; squaring of hard wood and barking of pine stems to facilitate removal from the forest; slipping in log and on sledges; in fact, every variety of forest operations; and I only wish some of our Indian overseers had been present to learn a few practical lessons and useful hints to be applied in our hill forests. The natural reproduction of hard wood is carried on in the same manner as described at Springe, but little or no damage is done here by game. The tracts of Scotch fir and spruce are generally replanted two or three years after being cleared, the roots having meanwhile been carefully dug up, and for the most part used for the manufacture of charcoal, which is extensively carried on.

The young trees (spruce and fir) are scarcely ever *slitted* Planting out of conifers. in as in Scotland, but pitted and transplanted with a ball. This is naturally more expensive, but, coupled with the careful previous cleaning of the soil, prevents the ravages of the beetle, which was formerly a very deadly enemy here. In marshy ground a plan called *Hügel* or *hill* planting is often adopted, which consists in merely laying the young plant, which has been removed with a ball, on the top of the turf or spongy grass, and placing round it another turf removed from the adjoining ground (thus forming a mound, whence the name). This plan appears to answer well, and I saw many hundreds of acres which had been planted by it on the upper plateau, of the Harz.

There are many other methods of planting adopted, too numerous to detail here. The steepest and most rocky sides of the hills are covered with forests which have been, so to speak, created by the ingenuity and labours of the forest department. In many such places, where even the few handfuls of soil placed round the young tree have had to be carried some distance, it is not contended that the first plantations will yield a direct pecuniary profit, but the improvement in climate by retention of the moisture, and reclamation of large tracts formerly barren and unproductive, is taken into account, besides which the droppings of leaves and needles from the trees will ere long create a soil and vegetation, and ensure the success of plantations in future years, and consequent surplus.

The Harz forests have from time to time suffered great Damage done by insects. damage from the attacks of insects, probably increased by the great dearth of small birds, which is most marked. Large sums have been expended in destroying the insects and

beetles, and of late years these have proved successful, and the damage been reduced to a minimum. The knowledge which German forest officers possess on this and kindred subjects is very great. The Oberforsters and even the Forsters and overseers can generally identify every beetle or insect met with in the forest, know whether it is destructive or harmless, and in the former case how it attacks the trees, and what measures are most effective in preventing or checking its ravages.

We visited several other reviers in the neighbourhood of Lauterberg, and thus obtained a good general idea of the forests of the Harz mountains, the portion of which situated in the province of Hanover extends over 204,000 morgen, and yielded, according to the forest budgets of 1864 to 1866, an annual surplus revenue of thalers 316,057, or about 4s. per morgen of the planted area, after deducting all charges for establishment, working, land tax, &c. Four-fifths of the forest area is spruce, and the remainder for the most part beech hochwald. The department maintained in 1864 270 miles (English) of forest roads in the Harz, and 480 miles throughout the whole province; and great attention is paid in each revier to the important matter of communications, without which the finest forest becomes comparatively worthless save in so far as it affects the general welfare of the country.

Saw mills.

In the adjoining revier to Lauterberg is a fine saw mill (water power), erected some years ago at a cost of 3,750*l*. The wheel drives one large rough-toothed saw (vertical) for quartering large beams, and eight vertical frame saws for planking. The system adopted is to debit the mill with all timber handed over to the manager at fixed rates, whilst he takes credit for the amount of sales to merchants. The balance and value of work performed by the mill is thus clearly shown, and the accounts of the executive officer remain clear and uncomplicated. I was informed that the results were generally favourable, but the department do not now have many mills in their own hands, and purpose selling this one; as competition has sprung up, and it is better if such operations as working up of timber can be carried on efficiently by private enterprise. All the departmental officers with whom I conversed concur, however, in stating that the saw mills, of which the State had formerly a large number, were a necessity, and have contributed greatly to the financial success of the department. I think we may gather a lesson from this for our guidance in India, where we cannot as yet expect private enterprise to erect and work

saw mills when and where required. We must set the example, and show the natives how to do it, saving at the same time a great deal of the waste of timber which now goes on, and must be felt sooner or later, only abandoning the mills and allowing them to pass into private hands, when we see that private enterprise and competition is sufficient to guarantee the carrying on the work in an efficient manner, and so as to supply the people with what they require without the evils of a monopoly.

The Lauterberg revier, and many of those bordering, so Servitudes to speak, on the cultivated area in the plains, are much burdened with servitudes, which reduce the actual cash profits to a very small sum. These rights or servitudes are all clearly defined and registered, and when, as is the case for the most part, they consist of timber for the erection of houses or firewood, it is the duty of the executive forest officer to supply the privileged parties with the quantities to which they are entitled at the time and place laid down. Should he, however, find or imagine that the demand from this source exceeds the supply or annual yield, or that the forest is being worked actually at a loss, it is his duty to bring the circumstances at once to the notice of the Forstmeister, with a statement of the reasons which induce him to do so. The matter would then receive attention, and, if necessary, a complete revision and revaluing or stock-taking would be made. Should the local officer's view be found to be correct the rights of the villagers would be curtailed, or even suspended altogether for a term of years, the conservancy of the forest for the general good being considered paramount to all individual or class interests or privileges, even when the latter are of long standing.

Of course this rarely happens, but instances have been known owing to bad or injudicious management, failure of natural reproduction, damage by storms and insects, &c. &c.

A trip to the "*Kloster*" forests at Ilfeld with the Forstmeister brought our stay in the Harz to a close. These have for the most part been treated as *Mittelwald*, but a considerable portion is now in process of transformation into *Hochwald*. It struck me both here and in the *Mittelwald* at Rothenberg revier that too many standard trees were as a rule left over, and that the coppice was in consequence poor and rarely attained any size. The proportion of trees to be left over in this description of forest is laid down as 12 *Bäume*, or trees of the oldest class; 18 *Oberständer*, trees of medium age; and 30 *Lasreidel*, or saplings left from the last clearing—60 trees in all, equivalent to 80 to our English

acre, in addition to the coppice. The length of rotation varies from 20 to 30 years, and the coppice is estimated to produce 20 cubic feet per morgen per annum, whilst the standard trees as above should, under favourable circumstances, exhibit an annual increase of from 30 to 35 cubic feet per morgen.

Oak coppice.

The oak coppices which I subsequently visited with the *Forst-direktor* appeared very well managed, and yield a large profit. The young oaks are "schooled" for two years, then cut over and planted out, after which they are coppiced for the bark every 16 years; the young wood of other sorts, such as birch, ash, hazel, &c. which may have sprung up having previously been cleared out, along with any oak shoots of no value for barking, and sold as firewood.

Excursions.

The last ten days of my stay in Hanover were devoted to the study and making extracts of working plans and short expeditions to reviers in the neighbourhood with the *Forst Direktor* and some of our forest students then in Hanover.

During these trips we tested and put in practice the various methods prescribed for estimating and valuing the quantity of timber on a measured area, the various instruments for measuring height and girth and ascertaining the annual rate of growth.

The most accurate information has been collected and statistical tables compiled by Herr Burckhardt with regard to the rate of growth, effects of thinning, comparative value of hardwood and coniferous plantations, methods of computing cubical contents of standing timber, annual increase, and many other kindred subjects. It would be impossible to give here even a very abridged statement of the results arrived at, and the same would not of course apply to India or even to England; still a study of the method in which the inquiries have been pursued and results deduced from the data acquired is very instructive, and should serve as a guide for similar researches in India, where they are much needed.

In the neighbourhood of Celle I had an opportunity of witnessing the method adopted for planting the fir successfully in moorpan or iron-band, extensive tracts of which have lain waste for centuries, and defied all the efforts of the forester. They are now gradually being covered with fine forests. The plan adopted is to plough, or, when necessary, trench with the spade to a depth of two feet or more, turning up the "iron-band" to the surface, where, in the course of one or two years it decomposes and becomes a most excellent and congenial soil for the growth of the Scotch fir.

The fine communal forest of *Eilenried* was also visited and its management explained. This forest may be said to environ the town of Hanover, and contains some of the finest oak trees which I saw in Germany. It affords a most charming public recreation ground, whilst at the same time producing a good revenue. Director Burckhardt also took us to a revier where the so-called *Plänter-betrieb* or *Wirthschaft* was still to be seen. This method of treatment approximates to what we are doing or have been trying to do in our Madras forests, and I believe in India generally, *i.e.*, merely to fell trees of the better descriptions as they arrive at maturity. It is generally condemned throughout Germany as, unless most carefully managed with numerous and well-considered restrictions, it must lead sooner or later to a paucity of mature trees to produce seed, and hence to a deterioration in quality of the young crop, and eventually to the extinction or destruction of the more valuable descriptions by others more hardy, and saved from the axe by their comparative worthlessness.

“Plänter-
betrieb.”

The method adopted for the transformation of such tracts into regular plantations or forests is very instructive, consisting in gradually thinning out the less valuable sorts or white wood and encouraging the growth of thick clumps or groves of those which it is wished to retain, which gradually reproduce themselves, and eventually, aided by artificial sowing or planting where required, cover the ground and constitute a close and regular forest.

It would not do to condemn the *plänter-betrieb* entirely for India, as, within certain limits, it has its advantages, but there is no doubt that we should at least experiment as above, and favour the more valuable timber trees at the expense of the inferior descriptions. Some idea of this did present itself to Mr. A. J. Stuart, sub-collector of Tinnevely, early in 1871, and proposals on the subject were under consideration when I came home.